Madison Education Partnership

Mathematize Your CLASS 2:
Supporting 4K Teachers through Remote Professional Learning Communities

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The Madison Education Partnership (MEP) is a research-practice partnership between the University of Wisconsin (UW) – Madison School of Education's Wisconsin Center for Education Research and the Madison Metropolitan School District (MMSD). MEP provides a context for collaborative problem identification, jointly designed empirical research to address problems of practice, development of educational interventions, and the creation of mutually beneficial lasting relationships across the UW and MMSD. The partnership serves as a conduit to establish new research within the district, enhances research use for the district, and creates mechanisms for the dissemination of new knowledge in Madison and beyond.

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Executive Summary

This report documents the design and implementation of *Mathematize Your CLASS 2*, a program facilitating professional learning communities (PLCs) that the Madison Education Partnership (MEP) offered to thirteen teachers of four-year-old kindergarten (4K) in the Madison Metropolitan School District (MMSD).

Findings from our 2019-2020 professional development (PD) series*, Mathematize Your CLASS*, indicated that giving teachers time to collaborate around pedagogical challenges and to engage in discussions around one another's practice enhanced professional community and led to improvements in instruction. PLCs served to reduce teacher feelings of isolation and presented the opportunity to promote effective PD strategies, such as collaboration, reflection, and feedback. In the present study, we continued this work to facilitate PLCs that support teacher adaptation of instruction to meet Wisconsin Model Early Learning Standards through remote and in-person instruction amid the challenges of the COVID-19 pandemic and provide an avenue through which 4K teachers could connect with colleagues. Through this program, we (1) explored how remote, teacher-led PLCs supported engagement with PD content and (2) examined how teachers approached instructional adaptation in the context of these groups. The report outlines the design of the project, findings, and reflections.

We learned the following:

- Remote PLCs can sustain educator engagement with PD content.
- PLCs comprised of teachers engaged in different instructional modalities yield benefits and drawbacks for participants, suggesting the importance of teachers' instructional environments within PLC composition.
- Participants sustained their collaborative involvement as the program shifted from the structured format of the prior year's PD series to teacher-led PLCs, regardless of whether or not they were acquainted with their group members from the previous year.
- Teachers adapted pedagogical strategies in the face of novel constraints by shifting the materials they used for instruction and changing the size and timing of instructional groups.

Our primary recommendation is that MMSD continue to facilitate teacher collaboration, with remote and in-person options. In addition, we recommend continued involvement of teachers in the PLC design process and promoting PLC recruitment to include greater diversity of staff experience. MMSD is presently engaged in facilitating such programming.

Mathematize Your CLASS 2

MEP engaged MMSD staff members and UW-Madison researchers to facilitate professional learning communities for 4K teachers within MMSD. We drew on the input of design team members to create a five-month PLC series that supported teachers in adapting remote and in-person instruction to meet state early learning standards. The primary goal of our study is to explore the impact of facilitated collaboration among 4K teachers, who are often isolated from one another by program structures. For example, several participants are the only 4K teachers in their schools and therefore do not have grade level colleagues with whom to discuss instruction. *Mathematize Your CLASS 2* (MYC-2) created a space for these teachers to connect with their peers at school-based sites, early care and education sites (ECEs), and in Head Start programs. The COVID-19 pandemic informed project design and content, creating an opportunity to explore the role of remote PLCs in supporting teacher instruction and community.

Rationale

During the 2019-2020 school year, we developed, implemented, and studied a year-long PD series focused on early mathematics and quality instructional support titled *Mathematize Your Class*. Teachers who participated in the series reported valuing the embedded PLCs and opportunities for peer learning. The present project builds upon the relationships developed during the initial year of funding, facilitating PLCs among 4K teachers to support mathematics instruction in remote and in-person environments.

Project roles

Our research team consisted of MEP leadership and staff, MMSD's Director of Early Learning, and two graduate assistants. For a full list of team members, see Appendix A.

Designing PLCs

We engaged MMSD's Director of Early Learning, two university researchers, and four teacher mentors in the design process for MYC-2. Our four teacher mentors also supported development of the prior year's PD series. We drew upon these relationships and teachers' existing experience with MEP collaboration to springboard the development of our PLC program.

The design team met in October to conceptualize the program and agree upon program goals. In this meeting, mentors emphasized the need to provide clear guidelines for participation and to ensure that our program supported teachers rather than overwhelming them during a complex time period. We agreed that MYC-2 would 1) facilitate mathematics-focused PLCs that support teacher adaptation of instruction to meet Wisconsin Model Early Learning Standards through remote and in-person instruction and (2) provide space for 4K teachers to connect with one another. We then met in November to discuss logistics and again in February to ensure that the program as implemented aligned with our goals. For a full project timeline, see Appendix B.

Recruitment of participants

All prior participants in our PD series who successfully completed the program and were still employed as 4K teachers received email invitations to participate in MYC-2. These invitations outlined the structure of the program, objectives, activities, and compensation. Of the 18 teachers invited, thirteen teachers participated in the program, including four teachers who served on our design team and committed to act as mentors. As we received substantial interest from those who were already familiar with the work, we chose not to extend recruitment to teachers who had not participated in the PD program the year before.

These selection criteria limit the generalizability of this program. We recruited teachers who previously demonstrated motivation to participate in professional opportunities outside of their school day and who held a moderate amount of teaching experience, though teachers represented varied site types and engaged in different instructional formats (see Table 1). Future extensions of this programming must account for diversity of practitioner experience, instructional support needs, and varied motivations of participants.

Structure of MYC-2

We recruited participants following our October design meetings, requiring participant commitment by October 21st, 2020. Once we heard back from our teachers, we formed three PLCs (see Table 1). Initially we planned to form PLCs based on when participants could meet; however, mentors spoke to the benefit of preserving PLCs and developing existing relationships from the prior year's work. The Yellow and Red PLCs comprised teachers who worked together in the prior year's PD to leverage previously developed social relationships and rapport. We then combined the remaining four participants who represented three separate PLCs from the year prior into the Rainbow PLC. Two teachers in the Rainbow PLC acted as mentors in the prior year, and we chose to keep them both on in this role for MYC-2.

Table 1: PLC Assignment by Site Type and Instructional Format

PLC	*Site Types*	*No. of Members*	*Primary Instructional Format*	*No. of Members*	*Total Members*
Red	ECE/ Head Start	2	In-Person	1	5
	School	3	Remote	4	
Yellow	ECE	2	In-Person	2	4
	School	2	Remote	2	
Rainbow	ECE	1	In-Person	1	4
	School	3	Remote	3	

PLCs engaged in four meeting cycles, each organized around a domain of mathematics instruction: numbers and counting; shape and spatial relationships; measurement and data analysis; and operations and relations (see Table 2). To support development of instruction, we provided access to a collection of lesson plans that we created for the PD series the year prior called the math matrix (Appendix C). We also delivered hard copies of these activities to teachers for ease of reference during video-conference meetings. Teachers engaged in a cycle of planning, observing, and reflecting upon instruction for each of these domains. Some groups chose to teach the same lesson from the math matrix that aligned with the month's featured domain, while others selected varied lessons and then contrasted their experiences.

Table 2: Initial Schedule of Activities

Month(s)	*Focus*
November/ December	Cycle 1: Numbers and counting
January	Cycle 2: Shape and spatial relationships

February	Cycle 3: Measurement and data analysis
March	Cycle 4: Operations and relations
April	Program reflection and presentation planning
May	Culminating celebration and sharing presentations

Teachers shared their practice in several ways. Some groups chose to film their instruction and share their videos with their colleagues to watch outside of meeting time, as opportunities for in-person observations were unavailable due to program responses to COVID-19. Other groups created slideshows with pictures of their lessons that they presented during PLC meeting times. We offered flexibility so that teachers could convey information in a manner that best fit their needs, while minimizing activities that could spread COVID-19. Though some participants said that they missed in-person observations, they were glad for the opportunity to observe their colleagues' practice. As one participant described, "To be in all those different classrooms and watching my PLC teammates teach was really amazing. And I'm thankful to still have had that opportunity and to be able to be in my own home while I do it." Further, as participants did not engage in in-person observations during the school day, this system did not require provision of substitute teachers to cover classes.

Each PLC determined when to meet, in what order to address the domains, and how to approach planning, observation, and reflection in a manner that best suited the needs of their group members. PLCs met remotely between five and seven times via video conferencing software over the course of the program (see Appendix B), with additional PLC communication taking place via email and asynchronous observations of group members' teaching practice facilitated through video recordings.

Final meeting

We held a final meeting with all PLC members to celebrate the end of the program, facilitate participant connections across PLCs, and solicit feedback regarding MYC-2. During this remote event, participants presented an annotated lesson plan that they adapted during the school year to a small group with participants from other PLCs. In addition to providing teachers an opportunity to learn from the work of colleagues in other groups, their final projects provided further information regarding teacher adaptations of the state learning standards in practice. We introduced this project via email in February. Teachers submitted their projects in .pdf, PowerPoint, or word document formats before presenting at the final meeting.

Obstacles

This series began while MMSD teachers were teaching remotely during the COVID-19 pandemic and most ECE sites teachers held in-person instruction. This period featured evolving guidance on safety protocols and uncertainty regarding when school-based teachers would return to in-person instruction. The pandemic shaped our study design, including recruitment, meeting frequency, and content covered within PLCs, as we aimed to consciously consider the capacity of teachers while continuing our research. In March, MMSD 4K teachers returned to school with their students. The adaptations that teachers engaged in during this time created some scheduling difficulties for participants in the Rainbow PLC, who conversed via email rather than meeting for a final time in April. Further, the unprecedented task of teaching during a pandemic shaped our participants' engagement in PLCs more broadly.

Findings

Teacher Perceptions

Teachers expressed that remote PLCs sustained their engagement in PD content and facilitated interpersonal connections. Observations of PLC meetings supported these assessments. Specifically, teachers:

- Identified PLCs as places to troubleshoot and improve their instruction.
- Felt that PLCs contributed to broader connections and instructional quality in the MMSD 4K community.
- Valued remote observations and meetings as a tool for reflecting and connecting with one another.
- Who engaged in remote instruction valued the opportunity to learn from and troubleshoot with their in-person peers, particularly when transitioning back to in-person instruction themselves.

We also identified opportunities to support future PLCs by:

- Providing access to more PD materials, namely resources for teacher learning, to support teacher discussions in PLCs.
- Promoting teacher buy-in, as this supported quality engagement in PLCs.
- Considering composition of staff teaching experiences and contexts when determining PLC rosters and accompanying goals.

Peer learning

Teachers identified opportunities for peer learning as a primary benefit of PLCs. Participants frequently mentioned the utility of “bouncing ideas” off of one another and drawing on the knowledge and experiences of their colleagues to think through the implementation of lessons.

> It's just hearing from one another and within that, growing, reflecting, asking the questions and just hearing different people's viewpoints or seeing how they deliver the same lesson but in a different way. And this kind of helps to open up and challenge myself as a teacher, too. Like, “Oo, yeah, should I be doing that? What if I tried it like that?” You know, that kind of a thing. That part's exciting.

Other teachers spoke to larger benefits to their work as teachers, as PLCs provided a space for them to continue to develop their practice and stay current with pedagogical innovations. A participant expressed, “I also feel like if I'm going to take practicum students and student teachers, then I have a responsibility to them to stay as progressive and innovative as possible.”

Another teacher referenced the benefit that PLCs have for the broader 4K community, noting, “I just feel like when we stay connected, as a community of teachers, we're better at keeping education real and fabulous because we're talking about it with one another and we're excited about it.” Participants in MYC-2 felt that PLCs helped them formulate instruction and supported their development as teachers.

Team-driven discussions

A salient difference between MYC-2 and our PD series from the year prior was a shift from semi-structured PLCs to groups that were teacher-led. Though each PLC had mentor teachers to facilitate discussion, the dynamics that emerged in MYC-2 were more team-driven than mentor-driven. In the absence of structured protocols, teachers continued to work together to

plan instruction and discuss problems of practice. Mentors spoke to this dynamic, with the Yellow team mentor explaining:

> I feel like this year it felt like more of a collaborative effort than it did me mentoring. I think it felt more like we had this connection from last year and then we just kind of went with what was happening and as everything was so uncertain, nobody really knew what was happening most of the time. So, it was just talking about what we were doing and what had worked and what had not. So, it kind of felt more like just a group of people. Like, we all had equal voice and were able to really offer each other different feedback and collaboration on what to do.

A mentor from the Rainbow PLC, a group who had not all worked together in the previous year, shared a similar sentiment:

> It didn't really feel like mentoring this year. It felt like all of us were kind of on equal footing. You know I, last year definitely there was more of that mentor role. I felt that I had to communicate all this information and try to make sure everyone understood what was going on and try to lead the discussion. And I didn't feel that this group needed as much of that. And they were very willing to participate and share.

As confirmed by observational data and interviews, PLC members engaged in collaboration and discussion regardless of having worked together in the past.

Community and connection

Teachers also told us that the PLC program was an opportunity for them to connect with their 4K community.

> We're disconnected as 4K teachers a little bit from the school, anyways. We have to work a little harder at that, and then we're a little bit disconnected from other 4K teachers because we're in different schools so we work a little bit harder at that. But, like with the community sites, we often have no clue what one another are doing, even though we're technically all MMSD 4K. So, I feel like MEP is a way to pull us all together.

Several participants found this connection especially salient during the COVID-19 pandemic. In describing her participation in MYC-2, one teacher mentioned, “I think a lot of us are looking for connections when we feel pretty isolated. So, I think it's just another way to tap in and build connections in another area too.” Another participant referred to PLCs as a “source of positivity” in an otherwise uncertain time, noting that her group provided emotional, in addition to instructional, support.

Teacher buy-in to the program supported this connection. As a mentor described:

> I think the success of this is, I think year two, the people that were in it really loved it. And they were committed to it. And their participation was at a much higher level. So, I don't know how you do that with mandatory PD or things that people have to do, but investment or buy-in somehow really makes a huge difference.

As participants in MYC-2 had prior familiarity with MEP and experience with the PD series, they shared a common language regarding mathematics instruction and expectations about participation in the program. This mentor describes the importance of personal motivation in supporting strong PLCs. Expansion of PLCs must contend with how to involve participants with a broad array of motivation while promoting quality of engagement. Strategies include leveraging existing professional relationships among teachers to promote buy-in.

PLC format and content

The flexible format of MYC-2 supported continued teacher engagement in the PLCs. One participant contrasted the activities required in MYC-2 with the more intensive commitment of the PD series from the prior year.

> With all things considered, and all the craziness that's been happening this last year and a half, I feel like it was really nice just to have a small group to focus on, and not a lot of assignments, and us just being able to sit, and talk, and figure out what activity we wanted to do, review them. It was so much more manageable for me.

Teachers also appreciated the depth and quality of resources. In discussing the math matrix, one participant noted:

> We had a lot of resources that we could use and I have been digging through there and using them in the classroom. And you know, just that hands on things that you can actually utilize, which was so helpful.

Though participants expressed similar sentiments regarding instructional resources, one teacher expressed wanting more directed learning from university staff akin to the past year's PD series. She noted, "Maybe [PD leaders] could each record themselves presenting some type of [lecture]-- and it doesn't need to be long, it could be 15 to 30 minutes just on a topic, just to kind of get the gears going."

Participants offered mixed perspectives on the remote format of PLCs versus in-person format of PLCs. Though MYC-2 had to be online due to COVID constraints, some participants found this format preferable. As one teacher suggested:

> Oddly, I might suggest keeping it kind of virtual. Like, it was such a timesaver. And, even seeing videos of what was going on in the classroom. I loved the year when we got the release time to go and see other classrooms. Like, don't get me wrong, I love that. I think that would be great. But there certainly was utility in like having it all virtual. Um, or even just for the meeting parts.

Another teacher, however, expressed a strong preference for in-person over meetings. As she put it, "As much as I am thrilled to be with the kids all day long, I also miss us getting together and physically being together."

Teachers appreciated having the opportunity to observe their peers. As one mentor explained, "Sometimes you take things back to your own classroom, you do it, but you don't ever get to see it expanded or done in an alternate way. And so, it's really beneficial." Though participants were glad for the opportunity to observe each other's instruction through Zoom, some expressed preference for in-person observations. As a teacher summarized:

> I also enjoyed going to the other people's classrooms. Yes, it's a video, but to sit in [groupmate's] classroom, I learned so much, versus a five-minute video I watched of her. [...] Obviously, it's COVID, and we are grateful that we could do it this way. But I'm hoping that future math groups start out the other way so that they can have those same experiences.

Interestingly, remote teachers especially valued observing the work of their in-person colleagues. Several participants mentioned that observing these practitioners engendered positive feelings about their own capacity to return to in-person instruction. As one group member summarized:

> Especially the community sites who had been in person, I felt like through their wise words of wisdom and just their experiences, were almost like, "You're good. We're doing it. It's okay. Here's how we've done it." Even watching their videos was super helpful. Like, "Oh, alright, you can navigate your way with masks on."

PLC observations of in-school teaching thus provided a model for remote teachers to follow as they maneuvered back to in-person schooling. Whereas remote practitioners reported benefitting from the experiences of in-person teachers, in-person teachers did not identify the instructional format of their remote peers as salient to their learning. This imbalance of benefits between in-person and remote teachers highlights how staff composition of PLCs may lend itself to differential outcomes for teachers based on their programs or instructional formats and is important to consider when determining the goals of PLCs.

Instructional themes

MYC provided a space for teachers to plan, observe, and reflect upon instruction. It also provided researchers a glimpse into teachers' varied instructional adaptations. We identified themes regarding adaptation of instructional materials and formats in PLC conversations and interviews. These themes highlight how teachers differentially adapted instruction to meet Wisconsin Model Early Learning Standards as informed by their teaching settings.

Materials

Though all teachers reported adapting instructional materials, remote teachers and in-person teachers differently approached these adaptations based on their respective settings. As an in-person teacher described:

> At the beginning of the year, we always set, put out less learning materials. So, it's not so overwhelming. But this year, with also putting out less materials, we looked at, "Okay, which materials are going to be easy to clean, which materials are they going to be using that are going to be close to their face."

This teacher cited both the practical constraints of cleaning materials as well as her professional understanding of how children would interact with materials when modifying instruction in response to pandemic-related shifts.

Remote teachers adapted instructional materials based on what they perceived students could access in their respective households. In some instances, teachers adapted instruction to integrate materials from district- and teacher-disseminated math manipulatives packages for students. However, teachers sometimes chose to eliminate the use of materials in lessons that otherwise called for them. A mentor described to her colleagues that, despite receiving

manipulatives to use at home, many students did not access them during instructional time. She explained her rationale for changing an operations and relations lesson accordingly:

> Because the kids are having a hard time, bringing their supplies. Even though they have a lot of stuff that I've given them to use. So they're having a hard time bringing it.[…] That's why I did it the way I had it, with I have the [manipulatives]. And then I'm showing them. And then they can tell me.

Though both in-person and remote teachers faced limitations to the types of materials they could use, these limitations and teachers' consequent adaptations manifested differently based on teachers' settings.

Formats

Teachers in both settings spoke to adapting instructional formats, particularly in relation to student group size. As one in-person teacher explained to her PLC:

> I'm the only teacher in the room, so someone always needs me. I'm always getting interrupted, pulled away and with all the cleaning and stuff, like, I have to serve everyone's snack, clean the bathroom between each use and stuff. But I feel like I'm finally getting to the point where I can sit with a small group for an extended period of time.

This teacher identified how she has shifted her practice to reinclude small groups in light of her classroom community's adaptation to the parameters of instruction during the pandemic. Remote teachers also adapted instructional formats in light of their teaching context, with one participant lamenting to her peers:

> I don't have small groups. […] Because I don't feel like I could get people. It's a struggle enough for one of my classes to get half of them on.

Though this teacher spoke to a desire to do small group instruction, she perceived that her students would face challenges accessing remote instruction at a specific time that could preclude their attendance from the small group lesson.

Conversely, another remote teacher described engaging exclusively in small group work:

> I have sixteen kids in each class, morning and afternoon, and that's just too many to Zoom all at the same time. And I know teachers are all doing this differently, but I just felt like that for the purposes of Zoom, I felt like children really wanted to talk with one another. And so, we do small groups on Zoom of eight children or less. And then sometimes, depending on how the students are doing or what we're observing that week, I'll set up little Zooms of maybe two or four kids, or one on ones.

This teacher indicated that, to facilitate dialogue among students, she adapted all of her instruction for small group formats. She also conducted additional small group sessions in response to student understandings or subject matter. While these teachers came to different conclusions about how to adapt their practice, they both drew upon their teaching settings and their understandings of students when deciding how to adapt instruction.

Though teachers discussed adaptations with colleagues, they often rationalized their decisions in terms of their instructional contexts and their practical experiences with students. These

varied adaptations speak to the ever-present influence of teaching context on instructional decisions. However, they may also illustrate reticence on the part of teachers to extend their teaching beyond familiar practices during a particularly tumultuous time period.

Reflections from MEP

We collaboratively identified program goals and co-designed PLCs with four teachers and the district director of early learning. We then facilitated math-centered PLCs over a five month period. We aimed to (1) explore how remote, teacher-led PLCs supported engagement with PD content and (2) examine how teachers approached instructional adaptation in the context of these groups.

We gained several important insights from this project. First, remote PLCs can sustain educator engagement in PD content, including areas of focus and specific teaching strategies. This engagement took on a different tenor, however, against the backdrop of vacillating COVID-related practices than it did in our PD series. PLCs were an important space for teachers as they established what instructional approaches were possible amid COVID-19 restrictions and then planned for instruction within these confines. Emotional support also played a large role in sustaining engagement in PLCs, as teammates affirmed one another's feelings regarding teaching during the pandemic and provided a space for candid debriefings alongside instructional planning.

Second, there are benefits and drawbacks to PLCs comprised of teachers engaged in different instructional modalities. During our PD series, we intentionally mixed teachers across Head Start, ECE, and school-based settings to increase communication and connection across these oft-divided programs. Similarly, in MYC-2, our PLCs comprised teachers across these programs as well as in-person and remote settings. While remote teachers spoke to the benefit of seeing in-person teachers' work, in-person teachers did not identify their remote colleagues' settings as salient to their work. PLCs comprised of teachers working in similar settings may be worth exploring depending on the intended goals of the work. Regardless of group composition, however, we remain confident that the benefits of PLCs can and should extend to staff with a greater diversity of experiences than those reflected in MYC-2.

Third, participants sustained their collaborative involvement as the program shifted from the structured format of the prior year's PD series to teacher-led PLCs, regardless of whether or not they were acquainted with their group members from the previous year. Our prior understanding was that establishing trust and rapport among teachers required structured interactions. However, our findings indicate either that such structures are not essential for developing trust or that participant familiarity with the structured format of the past year provided a shared understanding and language to carry forth in their work with other teachers. This finding holds broader implications regarding the power of gradually releasing responsibility for PLC engagement as teachers build capacity.

Finally, teachers adapted pedagogical strategies in the face of novel constraints by shifting the materials they used for instruction and changing the size and timing of instructional groups. Though all teachers reported adapting instructional materials and formats, remote teachers and in-person teachers differently approached these adaptations based on the affordances and constraints of their respective settings. Teachers invoked professional experiences and understandings of students when explaining these instructional decisions.

Overall, we met our intended goals for MYC-2. Teachers were satisfied with their experiences in the professional learning communities and demonstrated that remote PLCs sustained their

engagement in PD content. We also gained insight into the efficacy of remote PLCs and the instructional adaptations to materials and formats around which teachers engaged with their colleagues. Finally, we created a space through which teachers could sustain professional and personal connections during an isolating time period. The relevance and success of our program hinged largely on the involvement of our mentor teachers, and we encourage the continued inclusion of teachers in the design of future PLC programs.

Appendix A: Project Roles

Our research team consisted of MEP leadership and staff, MMSD's Director of Early Learning, as well as two graduate assistants. Each member of the project team had unique responsibilities and roles as summarized here:

- Eric Grodsky: Madison Education Partnership Co-PI, Professor of Sociology and Educational Policy Studies
    - brokered relationships; provided guidance on research design; facilitated meetings; secured resources; co-designed program
- Beth Vaade: Madison Education Partnership Co-PI, MMSD Research & Innovation Executive Director
    - facilitated collaboration between MMSD and MEP, including supporting recruitment, and communicating with administrators/leaders
- Culleen Witthuhn: MMSD Director of Early Learning, PD co-facilitator
    - co-designed program; supported recruitment
- Helen Rose Miesner: Research assistant
    - designed program study with input from research team; conducted fieldwork and analysis; supported program design and implementation as needed
- Amanda Kruger: Project manager
    - provided project management support; served as the main point of contact for participants and site partners; coordinated participant compensation
- Amanda Venske: Lead Transcriber and Office Support Staffer
    - provided general support for the implementation of the research study

Appendix B: Project Timeline

Activity	Date
Design team meetings	10.6.2020 11.4.2020 2.25.2021
Introductory interviews	11.18.2020 - 1.27.2021
Yellow PLC meetings	11.30.2020 1.18.2021 2.15.2021 3.15.2021 4.26.2021
Rainbow PLC meetings	12.16.2020 12.2.2020 1.13.2021 2.10.2021 2.24.2021 2.3.2021 3.18.2021
Red PLC meetings	12.3.2020 1.14.2021 2.4.2021 3.4.2021 3.11.2021 4.8.2021
Culminating meeting	5.12.2021
Concluding interviews	5.24.2021- 6.2.2021

Appendix C: Math Matrix

Early Math Matrix of Activities & Other Resources

We developed the early math matrix of activities as part of our 2019-2020 PD series to help equip teachers with tools and resources to implement high-quality instruction in early math. The matrix consists of two resources: 1) a curated package of early math activities encompassing number and counting, spatial relationships and shape, measurement and data analysis and operations and relations, and 2) a searchable matrix of those activities with keywords taken from the Wisconsin Model Early Learning Standards and Teaching Strategies GOLD (the assessment platform that accompanies Creative Curriculum, the 4K curriculum for MMSD and some other sites). To be used together, the first component is a PDF and the second is an Excel file.

For each of the curated activities, we generated a lesson plan highlighting important information about math concepts, developmental trajectories, and instructional support strategies. Specifically, each lesson plan included:

- The main math concept of interest;
- Mathematics developmental progressions, including the preceding developmental milestone(s), the focus skill(s);
- The Wisconsin Model Early Learning Standards (WMELS) the activity addresses;
- The Teaching Strategies GOLD Objectives the activity addresses;
- Appropriate assessment protocols;
- The materials teachers will need to complete the activity;
- An in-depth description of the format, preparation, instructional introduction and activity;
- Instructional support prompts for things to observe and questions to ask related to Concept Development, Instructional Learning Formats, Quality of Feedback and Language Modeling (from CLASS); and
- Ways to extend learning through interest areas or centers.

We curated activities from four primary sources:

- Where's the Math? Books, Games, and Routines to Spark Children's Thinking
- DREME | TE
- The Erikson Institute Early Math Collaborative
- Learning Trajectories
- Other texts, websites and teacher blogs.

We drew most activities from the first three sources. We reviewed and selected activities to 1) create a balance in the format of the activity, such as small group and whole group activities and those that could be easily adapted to fit multiple formats, including child-directed formats, 2) engage an assortment of modalities for learning, such as using picture books or integrating body movement, and 3) address the range of WI Model Early Learning Standards and Teaching Strategies GOLD Objectives related to each early math content area. For example, when selecting activities related to spatial relationships and shape, we ensured that not all activities were simply shape identification, but also covered composition and decomposition of shapes, three-dimensional shapes and recognizing shapes in real world experiences. We included a total of 87 activities.

Once we had curated activities to align with the priorities of Mathematize, we developed the early math matrix of activities to help teachers identify activities that met their instructional goals. We created search filters to allow educators to select lessons based on instructional priorities, including overarching math domain, specific math concepts, instructional format, and the

WMELS or Teaching Strategies GOLD objective that the activity supported. We also included the original source of the activity. MYC-2 participants were already familiar with the matrix from their work in the PD series.